

- DOE-1 ES-1 (and remainder of the document). Use of the terms for the hydrostratigraphic units: "uppermost aquifer," "uppermost unconfined aquifer," "uppermost confined aquifer" must be replaced. Use of the term "uppermost" in this document is not consistent with regulatory definitions and is to be discontinued. Use of the hydrologic descriptors "confined," "unconfined," "semi-confined" shall be restricted to uses describing the specific characteristics of the water bearing unit at the point of the measurement rather than as a descriptor of the whole geologic unit. Reference to the geohydrologic units of the conceptual model shall be as "upper hydrostratigraphic unit (alluvium)" and "lower hydrostratigraphic unit (bedrock)." This also applies to the use of the term "aquifer" for the alluvial and bedrock water bearing strata as the term "aquifer" gives the impression of great ground-water flows. Our hydrostratigraphic descriptors need to be put in the proper perspective.
- The basis for this comment is further supported by the first paragraph on ES-3 that states that "the bedrock ground-water flow regime is not well understood."
- DOE-2 ES-2 When using the chemical names of contaminants, use the abbreviations as well (CCL⁴, PCE, TCE, etc.). Also the main part of the Workplan needs a list of acronyms used, including the chemical abbreviations.
- DOE-3 1-1 Describe the Environmental Restoration Federal Facility Agreement and Consent Order, commonly known as the InterAgency Agreement and how it evolved and how it currently relates to the DOE ER program.
- DOE-4 1-2 The first paragraph discussion on the phases of the ER program is not consistent with the RFO ER program. For example, the Phase III Workplan for OU1 is not feasibility studies, in actuality, it is further characterization.
- DOE-5 1-3 The alluvial Workplan is for the characterization of the "alluvium and hydrologically connected bedrock" as per the alluvial Workplan.
- DOE-6 1-4 The second paragraph beginning "There are several..." should be deleted as it is unnecessary.
- DOE-7 1-8 The 1987 report did not designate IHSSs, but SWMUs.
- DOE-8 1-9 First paragraph, Conditional approval was given to the Alluvial Workplan.
- DOE-9 1-10 Section 1.3.2.2, Check with NPDES staff concerning the last sentence.
- DOE-10 1-10 Figure 1-4 is not a stratigraphic section. What are the references for section 1.3.2.3?
- DOE-11 1-11 Discussion of Arapahoe Formation needs a better description of the fluvial channel sandstones, how there are discontinuous (generally) in cross section but continuous along the axis. Come on, use some good graphics.
- Show a map with the hypothetical recharge areas.
- DOE-12 1-13 The text uses 1980 census data. Isn't 1990 data available? If not available, we need to state so.

- DOE-13 1-15 Is the EE going into this Workplan as well as the alluvial Workplan?
- DOE-14 1-16 Remove the operable unit boundary from the figures as there is geographic overlap of the OUs.
- DOE-15 1-17 Last line, referring to the 1967 rainstorm and the location of the runoff. Check aerial photos.
- Also, please provide DOE-ERD with two copies of all aerial photos that subcontractors have (specifically the ones Weston used in the alluvial Workplan).
- DOE-16 1-19 When references to mass are made, reference the activity (curies) and vice versa.
- DOE-17 1-21 First continuing paragraph, referring to the area east of the 903 pad. Make reference to the EG&G EM gamma surveys, including the 1989 and 1990 surveys.
- DOE-18 1-21 In referencing number of boxes, note the volume of boxes as possible.
- DOE-19 1-24 Last paragraph, first sentence: what isotope is the activity referring to? When noting an activity note the isotope(s) that are causing the activity. What is the reference of windblown contamination to the north. If this area is contaminated, then we need to assess this area in the alluvial Workplan so that the area can be properly posted and for access control.
- DOE-20 1-28 When referring to the NAPLs, include a discussion about the potential fate of the NAPLs after 20 years plus in the environment. What are the secondary compounds you are referencing?
- DOE-21 1-30 DOE-ERD wants a complete copy of the latest version of the geologic report, including the full scale cross sections, color photos and descriptions of the logs.
- DOE-22 1-30 What is Appendix B?
- DOE-23 2-2 First beginning paragraph, the discussion is unclear and Figure 2-2 does not "jive" with the discussion.
- DOE-24 2-2 Show a figure with locations of seismic lines.
- DOE-25 2-5 There are outcrops at the plant that do not appear to be indicated by the report. See Brent Lewis for locations.
- DOE-26 2-10 Note source of culverts in South Walnut Creek are incorrect.
- DOE-27 2-11 Note that Pond B-3 water is not currently being sprayed in the East Spray Field. This was discontinued in 1989.
- DOE-28 2-17 The figures showing contaminant plumes are 1989. Can we not make more current plume delineation figures? Also, we should make figures that list the contaminants (above ARAR) at each well location or area noted.

DOE-29	2-22	Technically speaking "soils" are the weathered surface material and not buried geologic unconsolidated material. Make this distinction in the text.
DOE-30	5-1	Clarify the section describing the relationship of the SAP and the FSP and QAPP.
DOE-31	7-1	This is the first I have heard of the interim report. Is this something that I just missed? What are the protocols for adding additional work? How will the Workplan be amended?
DOE-32	T1-1	What solubilities reflect those of solubility with water?
DOE-33		Tables In tables with data, make sure locations and times are shown where possible. Also, ARARs should be listed where possible.
DOE-34	T2-4A	This table is for "unweathered sandstone." Can any differentiation be made as to which sandstone this table is referring?
DOE-35	T2-10	Figure 2-21 refers to this table as 2nd Quarter data.
DOE-36	T3-1	Use footnote to reference the meaning of the data qualifiers A, B, D, U. Also, note (such as by asterisk in right column) parameters that maximum concentration exceeds the ARAR. On page 6, note that the radionuclides are "dissolved."
DOE-37	T4-1	The "analytical levels" need to be footnoted as to meaning as well as reference Table 4-2. Page 3, define TCL and TAL.
DOE-38	T4-2	Screening for radionuclides mentions beta, gamma, and alpha but does not mention the method. There is increased sensitivity to the method of rad screening at the site by the regulatory agencies as well as DOE staff. Footnote the table to indicate the methods to be used (i.e. fiddler, other).
DOE-39	T6-1	Under "access and use restrictions", there is no permanent prevention (institutional controls) of entry acceptable. Longevity of permanent institutional control is not acceptable as an alternative for access or use control. Under "treatment," add thermal to the "applicability of..." column. Under "in situ treatment," add in situ ground-water restoration under "applicab..." column.
DOE-40	T8-1	For the boreholes, in the "purpose" column, add a location descriptor.
DOE-41	T8-2	Does "soil" refer to soil or unconsolidated/consolidated geologic material from boreholes? If from boreholes, from what intervals will samples be taken?
DOE-42	T8-3	Note that radionuclides are "dissolved".

- DOE-43 T8-4 Are water "inorganic (page 1)" and metals (page 2) analysis filtered (typos)?
- DOE-44 F1-1 No comments.
- DOE-45 F1-5 In addition to a generalized stratigraphic section, we should have a local stratigraphic section based on the geologic characterization report.
- DOE-46 FIGURES Remove the OU boundary from the figures. The "boundary may appropriate for administrative uses but not for specific RFO technical purposes.

Will color figures be used in the reports submitted to regulators? If not, then it should be considered, as done in the alluvial Workplan.

Figures should contain the northing/easting coordinates along the edges of the figures for geographic reference (and for those wishing to digitize information from figures like myself!).

- DOE-47 F2-2 Reference the source of data used to draw contours. Extend contours outside of the OU boundary, since the boundary will be removed.
- Text from page 2-2 and figure does not adequately illustrate the paleovalleys, clarify text and figure.
- DOE-48 F2-4 (and F2-5) Add to explanation the shaded areas (subcrops).
- DOE-49 F2-6 (through F2-8) Add the A(west)-A(east)', G(south)-G(north)', etc to the appropriate figures as well an explanation to the figures (for example, what do the elevation numbers mean: BH31-87 has 5973' and 5965.8'. Are these the casing and surface elevations, respectively, or something else? Also, add vertical scale on the sides of the cross sections.
- DOE-50 F2-9 This figure is too busy. A depth-to bedrock figure would be more appropriate.
- DOE-51 F2-10 The seeps are not "potential."
- DOE-52 F2-11 Potentiometric contours based on April 1988 data. Couldn't we use more current data or compare this data with more current data (1990)?
- DOE-53 F2-12 (through F2-20) "Lithology and well information" part of figure needs to be same vertical scale as the "groundwater elevation" for comparison purposes. Well IDs need to be reversed so they can be read the same way as the Figure text.

Another box with a generalized location of the wells of the figure should be added to the right of the "legend" box.

Another column should be added to the "apparent vertical ground-water gradients" to show the ground distance between the wells being used to establish the gradients.

The specific sandstone should be labeled on the well logs (i.e. Kass #1, etc.).

- DOE-54 F2-21 (through F2-23) Reference to Table 2-10 is incorrect. Use more current data for contours.
- DOE-55 F2-24 Under working hypotheses, No.1, add migration via borehole/well annulus/grout. Can we use some graphic artist to create a better conceptual figure (3d block figure)?
- DOE-56 F8-2 This figure should be labeled "initially" proposed boreholes/wells.

Table 8-1 should be referenced as containing details.

Figure/text needs explanations on spatial relationship of boreholes/wells in each area (i.e. within a 5 square foot area, 50 ft square area, 500, 5000, 50000 etc.)

Label the number of wells at each cluster. Since each cluster has one borehole, these need not be labeled.

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- DOE 57 A list of all the tables and figure should be provided in the table contents.
- DOE 58 All tables and figures should be in the text were first referenced not in an appendix.
- DOE 59 2-2 The colluvium also exists on the north side of the East Trenches.
- DOE 60 More explanation of the geologic characterization is needed. For example, The geologic characterization is an on-going program which will incorporate all geologic information Plant-wide for continued refinement of the geologic conceptual model. The combination of the geologic characterization and the HR seismic was not very complete, see comment 64.
- DOE 61 Reference to the 250 ft. thickness of the Arapahoe Formation can also be made in: Rockwell International, Task 2, High Resolution Seismic Reflection Profiling of the Arapahoe Formation at the Rocky Flats Plant. Final Oct. 89. and EG&Gb.
- DOE 62 The term "fluvial" in fluvial claystone and "lenticular" in lenticular sandstone should be erased or better explanation provided. For example, the sandstone are lenticular in cross section and not in three-dimensions.
- DOE 63 2-3 No conglomerate has been identified in the Number 6 sandstone nor any other sandstone at the Plant. In general the middle paragraph forces the geology into an idealistic model. The sandstones are not this clear-cut in their grain size distribution. The middle paragraph should be deleted and the general description already provided in the following paragraph used. The amount of fines i.e. silt and clay and cementation should be discussed in the geologic description. This has significant implications in later topics such the hydraulic conductivities and transport of contaminants. This is why some of our sandstones have the same hydraulic conductivities as the claystones.

- DOE 64 2-5 It is obvious there is not a good understanding of the seismic reflection data nor and attempt to make future use of it. This document states that the collection of additional information is needed to extract more information from the seismic however none is described in the this work plan. This project should be more concerned with the integration of the seismic data than the geologic characterization program for it was collected specifically for this Operable Unit. The addition of downhole geophysical logs and petrophysical testing and more extensive laboratory hydraulic conductivity testing are to be included in this workplan. Special consideration should be given to the shallow bedrock, areas that are usually by-passed with surface casing. A better discussion of differences and potential reasons why they exist between the seismic and the geologic model is needed. In reference to this discussion an overlay showing the areal differences of the #1 sandstone results and seismic lines lay-out should be presented. It should be reemphasized that the seismic results identify fluvial sequences i.e. claystone, siltstone and sandstone not just sandstones but channel sequences.
- DOE 65 2-6 The vast majority of wells already installed in the weathered claystone throughout the Plant are unsaturated. This information should be presented to help understand the potential of this being a pathway and how thorough a job we are doing.
- DOE 66 Inconsistency between paragraphs concerning the relationship of the valley fill and the creeks exists. The creek may be best described as being ephemeral.
- DOE 67 2-8 The Rockwell documents referenced here used the geometric mean of various hydraulic testing including pump tests. The pump tests were used within the calculation of the geometric means and should also be referenced. The reason why no slug test were performed in Woman Creek should be provided or the sentence should be deleted. The slug testing program should be prepared to handle thin saturated thicknesses. A brief discussion of why pump tests are not being used should be added.
- DOE 68 2-10 The high downward gradients described are actually potential gradients. This error occurs throughout the document.
- DOE 69 2-24 The 881 Hillside is not upgradient of OU2.
- DOE 70 2-25 The referenced figure should be 2-24 not 2-25. A thorough evaluation of the existing data should have occurred during the development of this document therefore the term "initial evaluation" should be deleted.
- DOE 71 4-2 Bullet #1 A better discussion concerning the objective of locating DNAPLs is needed for a perception problem exists. For example, the drilling program is not going to be searching extensively for small depressions where DNAPLs may collect. Major feature identified by drilling or seismic will be investigated as possible DNAPL collection areas. The thought that small pools not remediated would greatly impact any remediation is greatly overwhelmed the amount of clay found in all of the lithologies. The desorption potentials of the contaminants will control any long term remediation effort.

- DOE 72 Bullet #4: Please provide the well numbers in which the contamination occurred. This investigation must address the potential cross contamination problems of old wells, specifically 22-74.
- DOE 73 Bullet #3: The gradient at this time is questionable until quantification can be provided. The subtle sedimentation changes caused by the direction of deposition may disprove this notion. This is why quantification of the vertical as well as horizontal hydraulic conductivities are necessary for all lithologies at RFP. The quantification of claystones and siltstones are equally as important as the sandstones. This document focuses only on sandstone.
- DOE 74 Bullet #5: The 881 Hillside should not be considered as being upgradient of this operable unit. What are topographical or hydraulically upgradient solids ?
- DOE 75 Table 4-2 The use of ICP has not been previously mentioned as a field analysis technique.
- DOE 76 There is a problem in how the document flows from section to section. Brief general descriptions of the various approaches would not leave the reader hanging-on in suspense. For example, in previous sections reference is made to the drilling clusters. The general concept of what lithologies are being targeted does not materialize until table 8-1. A possibility for resolving this particular issue is a better general discussion in section 2 when reference to figure 2-24 is made. All of these potential pathways are described but never, until section 8, does the reader know the approach.
- DOE 77 8-3 Section 8.1.1 entitled Background should be removed and placed in a more applicable section. This section should discuss only the objectives of the placements and how it will be performed.
- DOE 78 The well identification numbers for the potentially contaminated wells should be provided. The reason why the bedrock ground water flow is not well understood could be touched upon.
- DOE 79 The geologic evidence that suggests significant bedrock flow occurs laterally should be stated i.e. subcropping on the hillsides.
- DOE 80 8-4 The word "suspect" should be deleted. The hydraulic conductivities and the geometry do control ground water flow.
- DOE 81 8-5 The rig geologist may select the screened interval in the weathered claystone due to the amount of weathering or fracturing i.e. secondary porosity which he is assuming to be secondary conductivity. This should be clarified.
- DOE 82 The GC screening will potentially select screened intervals. Rephrasing these sentences to indicate this is needed.
- DOE 83 Correlating the seismic survey with the weathered bedrock very important. Petrophysical and downhole geophysical logging information should be collected.

- DOE 84 It is quite possible that the targeted interval will be thinner or not consisting of the same lithology due to facies changes. The wells should be completed in these facies equivalents. Potentiometric surface maps will be generated for each depositional horizon (i.e. targeted interval).
- DOE 85 8-6 Justification for the lack of pump tests should be provided somewhere in this document.
- DOE 86 The slug testing program must be ready to handle thin saturated thicknesses.
- DOE 87 8-8 Geophysical logs are to be run in the deepest borehole of each cluster in order to obtain additional stratigraphic information. This is necessary for better integration of the seismic data and the geologic characterization program. The best method for integrating the seismic survey is to perform another Vertical Seismic Profile (VSP) in a cluster near a seismic line. In addition, laboratory hydraulic conductivities are to be conducted on claystone and siltstone units to better define the 3-D hydraulic relationships and provide correlations to the packer testing and downhole geophysical logs. An extensive suite of such laboratory testing should occur in several boreholes and the use of flow-pumps should be examined. This technique is routinely used by the USGS and the Colorado School of Mines.
- DOE 88 Well screened intervals are always above the bottom of the borehole.
- DOE 89 The selection of the screened interval may not be obvious and the use of packer test results may be helpful.
- DOE 90 8-9 In the event a targeted lithology is not encountered the BAT approach is to be used only if water level data can be obtained. The development of potentiometric surface maps and flow nets for each of the sandstone or depositional intervals of interest will eventually be developed.
- DOE 91 8-10 The use of the interface probes should be based upon the GC screening results. It is not necessary to perform this operation in every well.
- DOE 92 The most obvious disagreement between the seismic survey and the geologic characterization is the small channel sequence due north of well 16-87Br. A cluster should be drilled in this location with the deepest borehole to a depth of approximately 300 feet. Due to the proximity to the 903 Pad this is the best location for confirming the presence of DNAPLs in the weathered bedrock. An additional cluster needs to be drilled near well 22-74. This well is over 200 feet deep and is potentially cross contaminating the lithologies. Wells should be targeted by using the HR seismic and downhole geophysical logs.
- DOE 93 T8-1 The purpose of several drilling locations is solely for the geologic characterization. Better justification is needed for support of the is OU.